

On the Changes the Animal Secretions undergo during Cholera Morbus. By Mr R. HERMANN, of MOSCOW.

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WE make the following extract of a paper by Mr R. Hermann of Moscow, upon the changes which the secretions of the human body undergo during cholera, from the 6th number of the *Annalen der Physik und Chemie*, 1831, as very few minute investigations of this nature have been recorded in the many works on the subject of cholera, which have been published in this and other countries; and it is of the highest importance that every information should be made public concerning the nature of the disease, which seems now without doubt to have gained an entrance into England.

Having been commissioned by the constituted authorities at Moscow to institute chemical investigations into the nature of cholera, Mr Hermann made analyses of the blood, urine, and bile obtained from patients in different stages of the disease, as also of the vomited fluid and of the excrement.

At the commencement of his analysis of the blood of a cholera patient, he was surprised by finding that the clot contained a *free acid*. This he at first conceived to be a peculiarity in the blood of cholera patients, but he very soon found that his own blood, at a time when he was in perfect health, possessed the same, or rather stronger, acid properties than that of the cholera patient. Aware that chemists in general describe the blood as alkaline, he was induced to make an analysis of healthy blood, with a view of ascertaining the nature and quantity of the free acid which it contains.

Healthy Blood.—Mr Hermann's own blood, allowed to stand for twenty-four hours, until it separated completely into serum and clot, contained 57 of serum and 43 of moist clot in 100 parts. He found that the serum of this blood slightly reddened litmus, but not so powerfully as the clot did; and this he could not attribute simply to the colouring matter of the clot, as pure

water did not receive a colour from it so soon as the blue litmus solution was changed to red. By boiling the serum and clot with carbonate of baryta, in a vessel connected with a mercurial pneumatic apparatus, he found there were disengaged from 100 volumes of serum, 18.1 volumes, and from the clot 21.2 volumes of gaseous carbonic acid. 100 parts of the same clot were then boiled without carbonate of baryta, and there were disengaged from them 10.4 volumes of gaseous carbonic acid: 10.4 volumes, therefore, of the free acid in the clot, consisted of carbonic acid; the other 10.8 volumes he found to be acetic acid.

The blood of a healthy pregnant woman was analyzed, with very nearly the same results*.

Blood during Cholera.—In this disease the blood is known to be of a very dark colour, and thick consistence. Mr Hermann obtained the blood of a patient who had laboured under a very severe attack of cholera for a few hours. The blood was drawn four hours before death, after violent vomiting.

In 100 parts of blood there were forty of serum, and 60 of clot; consequently 17 more of clot than in the healthy condition. The specific gravity of the serum was 1.036, and this fluid was decidedly *alkaline*. The clot was acid. 100 parts boiled with the carbonate of baryta, as before, evolved 21.2 of gaseous carbonic acid, exactly the same quantity as was obtained from the clot of healthy blood.

Mr Hermann conceives that this separation of the blood into an acid clot and alkaline serum, is owing to the property which the fibrine has of absorbing a certain quantity of acid; and he considers it as a phenomenon analogous to the change which weak acids undergo, when wood is immersed in them; the wood absorbing a considerable quantity of the acid. Should, then, the whole quantity of acid in the blood be diminished, the fibrine still retains a certain portion of it; and, if the diminution be very great, the whole of the acid of the serum may be removed,

* It must be obvious that a much more extensive series of experiments than that adduced by Mr Hermann will be necessary to establish the accuracy of this result, differing so materially from that obtained by most chemists.

and this fluid will consequently exhibit alkaline properties, in consequence of the presence of subphosphate of soda in it.

The alkaline reaction of the serum in blood of those affected with cholera, is a very constant appearance. It only begins immediately after the patients have had evacuations by vomiting; and it again disappears when the patient survives the attack.

The following Table exhibits the differences observed by Mr Hermann in the composition and properties of healthy and diseased blood.

	Clot in 100 parts of Blood.	Serum in 100 parts of Blood.	Action of Clot on Litmus.	Action of Serum on Litmus.	Specific Gravity of Serum.
Blood of a healthy young man, .	43.	57.	Acid.	Acid.	1027
Blood of a healthy pregnant woman,	44.75	55.25	Acid.	Acid.	1023
Blood taken from a girl in the first stage of cholera, before the occurrence of watery evacuations,	50.	50.	Acid.	Acid.	1027
Blood from men who had the cholera, but recovered, } <i>a</i>	55.	45.	Acid.	Alcaline.	1028
Blood taken after watery evacuations, } <i>b</i>	60.3	39.7	Acid.	Alcaline.	1032
Blood taken after watery evacuations, } <i>c</i>	2.5	37.5	Acid.	Alcaline.	1028
Blood of a man labouring under cholera, four hours before his death,	60.0	40.	Acid.	Alcaline.	1036
Blood of a woman who survived the cholera, but had afterwards an attack of inflammatory fever, .	46.25	53.75	Acid.	Neutral.	1028

Mr Hermann states, that he found blood taken from the right ventricle of the heart of a patient dying of cholera, very firmly coagulated. When shaken a little, this blood became fluid, and quite homogeneous. Viewed in the microscope, no globules could be perceived in it.

Mr Hermann sought for urea in the blood of cholera patients, but in vain. No trace of it was discoverable.

Analysis of Watery Fluid vomited by Cholera Patients.—

This fluid is described by Mr Hermann as thick, of a dirty slightly yellow colour, and a sour smell. Its specific gravity varied in different patients, as 1.0060, 1.0055, and 1.0035.

When allowed to rest tranquil for some days, it becomes clear, while a grey-coloured mucus is deposited in variable quantity. By an analysis detailed by Mr Hermann, the differ-

ent steps of which we do not think it necessary to mention, he found that this fluid consisted of the following ingredients :

Water and mucus,	990.
Osmazomelike substance,	6.51
Salivine,	1.04
Acetate of soda, muriate of soda, with small quantity of phosphate of lime and magnesia,	1.56
Anhydrous acetic acid,	0.89
	1000.

A little butyric acid was afterwards discovered.

In the three specimens of the fluid which were examined, the quantity of acetic acid varied considerably. In 1000 parts of the fluid, of specific gravity 1.006, there were 1.204 parts of acetic acid; in that of specific gravity 1.0055, 0.942 parts; and in that of specific gravity 1.0035, 0.513 parts.

A very superficial glance at the results of this analysis of the vomited fluid, is sufficient, according to Mr Hermann, to shew its analogy with gastric juice.

Analysis of the Watery Excrement of Cholera Patients.—

The fluid excrement passed by cholera patients, Mr Hermann describes as turbid, slightly and dirtily coloured, and possessing a peculiar fetid odour, derived from the large intestines. When the fluid stands for some time, it does not become wholly clear, like that passed by vomiting. It is generally *acid*, both in its chemical properties and taste, as ascertained by Dr Reuss.

The fluid passed by stool resembles much in its chemical constitution that which is vomited. It contains a free acid, in some instances in considerable quantity, which is acetic; also butyric acid. The chief animal principles which it contains are mucus, albumen, salivine, osmazome-like substance, and a small quantity of picromel and resin of bile.

In the body of a man who died after having been affected twenty-four hours with cholera, and who had been purged without vomiting, the fluid in the stomach was found to be exactly the same as that vomited by other patients. In the duodenum the fluid resembled much that in the stomach, though it was not so sour. In the large intestine the fluid had the fetid smell of excrement, and was darker in colour, and more acid than the fluid in the stomach or duodenum.

Analysis of the Urine of Cholera Patients.—Mr Hermann states, that, as the urine is generally very much suppressed during cholera, he had no opportunity of examining this fluid at the time when the disease was at its greatest height.

The urine which he analyzed was procured from a person who survived the attack of cholera. It was the first passed after the suppression. It formed a turbid yellowish fluid, which gave no precipitate by standing, and was quite neutral in its relation to litmus. Its composition was very analogous to that of healthy urine, though the solid ingredients were in a much smaller proportion. It contained muriatic, phosphatic, and ammoniacal salts, as well as urica. Its specific gravity was 1.006; Now, taking the quantity of solid matter in urine of the natural specific gravity 1.020 to be 6.7 proc., the fluid of specific gravity 1.006 can only contain about 2 proc. less than a third of the natural quantity. Mr Hermann is of opinion that, whilst the suppression of urine takes place, the formation of urica, believed by many to be one of the chief modes by which nitrogen is separated from the living body, is entirely stopped, as no trace of this substance was to be found either in the blood or any other fluids of the body.

Analysis of the Bile of Cholera Patients.—The gall-bladder of patients affected with cholera, is known to be in general unusually full and distended with bile.

Mr Hermann obtained three gall-bladders, which contained respectively 14, 15 and 16 drachms of bile, of specific gravity 1.043. The usual quantity of bile found in the gall-bladder is, according to John, 1 ounce, and its specific gravity 1.026; there is, therefore, during cholera, nearly double the quantity of bile in the gall-bladder, and its specific gravity is considerably greater.

The three specimens of bile which Mr Hermann analyzed, were all of nearly the same colour as ox's bile, of a thready consistence, like thick syrup. Its chemical constituents were, a large quantity of mucus, some albumen, colouring matter, resin of bile, picromel, cholesterine, and oleic acid, &c. In comparing this analysis with that given by Tiedemann and Gmelin, of healthy bile, the only apparent difference, besides the greater

consistence and specific gravity of cholera bile, is probably in the greater quantity of resin of bile, as indicated by the copious precipitate thrown down by acetate of lead.

From these experiments it appears that, during cholera, the change in the composition of the blood consists in its being deprived of a large quantity of water, and some acetic acid, which, taking the quantity of blood in the adult person at 30 lb. amounts to nearly 8.5 lb. water, and 47 grains of acetic acid.

Mr Hermann conceives that it is principally in consequence of the removal of acetic acid from the blood, that the fibrinous polypous concretions arise in the cavities of the heart. In the healthy condition of the blood, he says that the acetic acid acts as a solvent to the fibrine; but, when a large proportion of it is removed, along with the vomited and purged matter, there arise these polypous concretions, which Dr Jähnichen invariably found in the cavities of the heart, in fifty bodies of cholera patients, which he dissected.

He also states, in confirmation of this opinion, that the alteration in the composition of the blood, does not occur till after there have been watery evacuations by vomiting or stool; and that the concretions of fibrine are much firmer, and more compact in those patients who linger for some time, than in those who die suddenly.

At the conclusion of his paper, Mr Hermann brings forward a theory of nervous excitement to account for the production of the changes previously mentioned to take place in the fluids and secretions of the body during cholera, and ends with a proposal for treatment founded on the chemical views given,—the injection of water into the veins being one of the remedies which he proposes.

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